Original Article

OPEN ACCESS

Hypertensive Retinopathy Spectrum in Tertiary Care Hospital Patients With Acute ST Elevated Myocardial Infarction

Daud Ahmad Jan[1], Tariq Nawaz[2], Wasim Sajjad[3], Adil Bilal[4], Sami ur Rehman[5], Rahid Ullah[6]

[1,3,4,5,6]Medical Officer, Lady Reading Hospital, Peshawar
[2]Assistant Professor Cardiology Unit, Lady Reading Hospital Peshawar

Author`s Contribution

[1,-3-6]Substantial contributions to the conception or design of the work; or the acquisition, Drafting the work or revising it critically for important intellectual content [2]Final approval of the study to be published

Funding Source: None
Conflict of Interest: None

Received: Feb 14, 2024
Accepted: July 06, 2024

Address of Correspondent
Dr Daud Ahmad Jan
Assistant Professor Cardiology Unit, Lady Reading Hospital Peshawar
drtariqnz@gmail.com

ABSTRACT

Objective: To ascertain the prevalence of hypertensive retinopathy in patients with acute ST elevated myocardial infarction.

Methodology: This descriptive cross-sectional study was conducted from May to November, 2019, at the Lady Reading Hospital's Cardiology Department in Peshawar. Patients of all genders, ages 40 to 70, were included. Two skilled ophthalmologists used a RIESTER ophthalmoscope to perform a fundoscopy. After a fundoscopy, consensus was agreed upon, and patients' risk of hypertensive retinopathy was evaluated. Hypertensive retinopathy was stratified by age, gender, smoking status, diabetes, and BMI to assess potential effect modification. Stratified chi-square tests were utilized, with a significance level of $P < 0.05$. SPSS version 20 was used to enter and analyze all of the data.

Results: The mean age of participants in this study was 58 years, with a standard deviation of 12.73. Male patients constituted 65% of the sample, whereas females accounted for 35%. Twenty-seven percent of the patients had hypertensive retinopathy, while seventy-three percent did not. Furthermore, hypertensive retinopathy showed no statistically significant associations with age, gender, smoking, diabetes mellitus, or BMI; the p-values were greater than 0.05, indicating insignificance.

Conclusion: The study findings conclude that 27% of patients with acute ST-elevated myocardial infarction had hypertensive retinopathy.

Keywords: Hypertensive retinopathy, Acute ST-elevated myocardial infarction.

Cite this article as: Jan DA, Nawaz T, Sajjad W, Bilal A, Rehman SU, Ullah R. Hypertensive Retinopathy Spectrum in Tertiary Care Hospital Patients with Acute ST Elevated Myocardial Infarction. Ann Pak Inst Med Sci. SUPPL-1 (2024): 495-499. doi. 10.48036/apims.v20iSUPPL-1.1014

Introduction

Cardiovascular disease continues to be the primary cause of global disability, imposing substantial social and economic burdens. Despite advancements in clinical care and medicine, they remain as the main causes of illness and mortality.[1] Acute coronary syndrome (ACS) is a common cardiovascular condition that ranks among the top causes of morbidity and mortality worldwide.[2] Various risk factors typically cause it to begin early in life.[1] The coronary artery disease, (myocardial infarction) typically results from atherosclerotic coronary arteries being unable to adequately supply blood to the heart, often due to partial or complete blockage of the arteries. Depending on whether persistent ST-segment elevation is detected on the electrocardiogram (ECG), the conventional classification of AMI distinguishes ST-segment elevation myocardial infarction (STEMI) from non-ST-segment elevation myocardial infarction (NSTEMI).[2] ST segment elevation myocardial infarction (STEMI), also known as transmural infarction, comprises roughly a third of all cases. Established risk factors include hypertension, diabetes mellitus, elevated cholesterol levels, and tobacco use.[3,4]

Arterial hypertension is a significant factor in the progression of atherosclerosis and the formation of unstable plaques, which can lead to acute coronary syndromes through their instability or rupture.[5] However, increased blood pressure initiates a series of physiological alterations in the blood vessels of the retina also.[6] Moreover, several studies indicate that people with hypertension and retinopathy have a greater chance of mortality and potentially facing more health issues related to cardiovascular diseases. Nevertheless, these studies are subject to significant constraints.[7]Supporting this, one

study found that hypertensive retinopathy independently increases the risk of post-acute STEMI complications in successfully thrombolysis patients, with 3.17 times higher relative risk.[6]

In patients with acute STEMI, hypertensive retinopathy (HR) may manifest as a result of long-standing hypertension or as an acute exacerbation of blood pressure levels during the myocardial infarction event. The risk factors for both retinal artery occlusion (RAO) and ST-elevation myocardial infarction (STEMI) are almost indistinguishable. Plaques can accumulate in the aorta, internal carotid artery, or their branches as individuals age, influenced by various cardiovascular risk factors.[8] Detachment of fragments from these plaques may result in the onset of acute RAO or STEMI through embolization.[8-10] However according to another hypothesized cause by studies the optimal treatment for STEMI is percutaneous coronary intervention (PCI) if performed promptly.

If PCI facilities are unavailable, it is advised to administer thrombolysis within thirty minutes of hospital arrival. Frequently used thrombolytic agents include streptokinase, alteplase, reteplase, and tenecteplase. For thrombolysis, Streptokinase is the most frequently administered agent in Pakistan. The most significant but often overlooked complication of Streptokinase is bleeding from delicate blood vessels in the posterior eye know as retinal haemorrhage. This may result in fibrosis in the submacular area and damage to the light-sensitive cells (rods and cones) in the eye, resulting in significant impairment of vision.[11]

Despite the well-established association between hypertension and retinal changes, there is a noticeable lack of studies specifically investigating HR in the context of acute STEMI. Existing literature predominantly focuses on the cardiovascular complications of hypertension, paying minimal attention to ocular manifestations in patients presenting with acute myocardial infarction. Consequently, there exists a critical gap in our understanding regarding the prevalence and clinical implications of hypertensive retinopathy in this specific population of STEMI patients in our country. Therefore, this study was conducted to assess the frequency of hypertensive retinopathy among patients with acute STEMI.

Methodology

After obtaining ethical approval from the research committee at Lady Reading Hospital, data were gathered from the Outpatient Cardiology Department of Lady Reading Hospital, Peshawar, between May 13, 2019, and November 13, 2019. Both male and female patients aged 40 to 70, who presented with acute ST-elevation myocardial infarction, had a history of hypertension for at least 5 years, and were currently receiving antihypertensive treatment were included in this study. Patients with a prior history of acute coronary syndrome, angioplasty or bypass surgery, congenital heart disease, cardiomyopathy, chronic kidney disease, diabetic retinopathy, cataracts or prior cataract surgery, and other retinal conditions such as pan-retinitis, maculopathies, or retinal photocoagulation were excluded. After informed consent was obtained, patients were admitted to the cardiology ward.

All patients underwent a comprehensive assessment, including a detailed history covering past medical information such as age, gender, and smoking status, followed by a routine physical examination. Basic investigations, including electrocardiography (ECG) and fundoscopy, were performed. A RIESTER ophthalmoscope was used by two experienced ophthalmologists for the fundoscopy. A consensus was reached on the ophthalmoscopy findings, and patients were evaluated for hypertensive retinopathy.

An ECG was performed for each patient diagnosed with acute ST-elevation myocardial infarction and a 5-year history of hypertension. Initial data collection included age, gender, smoking status, diabetes, and BMI. Exclusion criteria were strictly followed to minimize bias in the study results. Data were analyzed using SPSS version 22, calculating the mean and standard deviation for continuous variables such as age, height, weight, and BMI. Frequency and percentages were computed for categorical variables, including sex, smoking, diabetes, and hypertensive retinopathy. Hypertensive retinopathy was stratified by age, gender, smoking status, diabetes, and BMI to assess potential effect modification. Stratified chi-square tests were utilized, with a significance level of $P < 0.05$.

Results

The age distribution was analyzed as follows: 35 patients (20%) were aged between 40 and 50 years, 66 patients (38%) were aged between 51 and 60 years, and 73 patients (42%) were aged between 61 and 70 years. The standard deviation was 12.73, and the mean age was 58 years. The gender distribution revealed 113 male (65%) and 61 female (35%) patients. Among the 174 patients analyzed,

Table III: Stratification of hypertensive retinopathy with age, gender, type of STEMI, diabetes mellitus, smoking and BMI.

Parameter	Sub-division of parameter	Hypertensive Retinopathy		P value
		Yes	No	
Age group	41-50years	9	26	0.984
	51-60 years	18	48	
	61-70 years	20	53	
Gender	Male	31	82	0.864
	Female	16	45	
Diabetes mellitus	Diabetic	19	52	0.950
	Non-diabetic	28	75	
Smoking	Smoker	13	36	0.928
	Non-smoker	34	91	
BMI	<25kg/m²	21	56	0.944
	>25kg/m²	26	71	
Type of STEMI	Anterior	17	53	0.953
	Inferior	25	63	
	Lateral	5	11	

70 (40%) had anterior STEMI, 88 (50%) had inferior STEMI, and 16 (9%) had lateral STEMI in **table I.**

Table I: Distribution of age and gender of the patients.

Parameter	Age (years)	N	%
Age	40- 50	35	20%
	51-60	66	38%
	61-70	73	42%
Gender	Male	113	65%
	Female	61	35%
Type of STEMI	Anterior	70	40%
	Inferior	88	50%
	Lateral	16	9.0%

Status of diabetes mellitus was analysed as 71(41%) patients were diabetic while 103(59%) patients were non-diabetic. Status of smoking was analysed as 49(28%) patients were smokers while125 (72%) patients were non-smokers. Status of BMI was analysed as 77(44%) patients had BMI <25 Kg/m2 while97(56%) patients had BMI >25 Kg/m2. Mean BMI was 25 Kg/m2 with SD ± 5.818. 47 (27%) of the patients had hypertensive retinopathy, while 127 (73%) did not. The frequency of hypertensive retinopathy was examined. Table II

Table II: Frequency distribution of various variables in the study sample.

Parameter	Yes/No	N	%
Diabetes Mellitus	Yes	71	41%
	No	103	59%
Smoking	Yes	49	65%
	No	125	35%
BMI	>25 kg/m²	97	44%
	<25kg/m²	77	56%
Hypertensive Retinopathy	Yes	47	73%
	No	127	32%

Stratification of hypertensive retinopathy with respect to age, gender, smoking, diabetes mellitus, BMI is given in table III.

Discussion

Both ST elevation in myocardial infarction and hypertensive retinopathy are manifestations of vascular dysfunction. Chronic hypertension leads to endothelial damage and arterial remodelling, predisposing individuals to atherosclerosis and thrombotic events, which can culminate in myocardial infarction with ST elevation. Similarly, the structure of retinal vessels changes due to elevated blood pressure, contributing to retinal ischemia and hemorrhages seen in hypertensive retinopathy. [12]

Major complications like stroke, renal failure, and retinal vascular occlusion and heart failure frequently begin before retinopathy.[13,15] In our study, from a total of 178 participants 113 (65%) and 61 (35%) were male and female respectively with mean age of 58 ±12.73 years. Additionally, 27% of the patients had hypertensive retinopathy, while 73% did not.

Coronary angiography and fundus examination were used to diagnose individuals with acute coronary syndrome (ACS) in a study conducted by Wang J et., in 2015. 436 participants were divided into three distinct group: patients with no retinal artery lesions were placed in group 1(n=111) and 135 (31%) individuals with retinal artery lesions classified as <Stage 2 (Stage 1 exhibits broadening of the light reflex with minimal or no arteriovenous compression). Whereas third group comprised of 190 patients with retinal artery lesions classified as ≥Stage 2. Stage 2 and stage 1 depicted similar changes but more pronounced in stage 2, while arteries in stage 3 exhibited significant arteriovenous compression and a 'copper wire' appearance, and stage 4 showcased arteries with a 'silver wire' appearance and severe arteriovenous crossing changes. [6]

In a study conducted by Jibran MS et al[14], 118 patients, with an average age of 54.83 ± 8.6 years, participated, among whom 49.2% were male. The severity of hypertensive retinopathy (HR) among the patients was categorized as follows: 17.7% had severe HR (n=21), 21.1% presented with moderate HR, 22.8% exhibited mild HR and 38.1% showed no signs of hypertensive retinopathy (HR). The study found that primary endpoints were met by none of the patients without hypertensive retinopathy (HR) and by 19% of those with severe HR (χ^2=18.1, p < 0.001). 2.2% of patients without HR and 40.7%, 56%, and 100% of patients with mild, moderate, and severe HR, respectively, achieved secondary endpoints (χ^2=81.1, p <0.001). Hypertensive retinopathy was associated with a 3.17-fold increase in the relative risk

of complications ($p < 0.001$) and a 1.75-fold increase in the risk of mortality ($p < 0.001$). Previous research has consistently shown an association between HR and cardiovascular disease (CVD).[15] Moreover, the development of fibrous nodules and fibrinous degeneration in cerebral vessels have been linked to thickening of the retinal arteries.[16]

The study has demonstrated an association between carotid intimal thickness and the retinal arteriolar-venular ratio[17]. Hypertensive retinopathy (HR) was found to double the risk of cardiovascular disease, according to Duncan et al.[18] Wang et al. found in a case-control study that HR patients were at 1.8 times higher risk of coronary artery disease.[19] The Atherosclerosis Risk in Communities study indicated that the stroke risk increased to 2.6-fold in individuals with HR. In addition, a correlation between HR and complications following STEMI in patients receiving thrombolysis was found in another study.[14]

Up to now, existing studies have focused on the new onset of cardiovascular disease and its correlation with hypertensive retinopathy (HR), or the link between HR and the severity of coronary artery disease seen on angiography. Our current findings are highly encouraging, showing a robust connection between HR and complications following successful thrombolysis in patients with STEMI. In addition, the proportion of patients with severe HR who developed post-STEMI complications steadily increased from the group without HR.

As hypertensive retinopathy (HR) severity advanced from none to severe, there was a corresponding increase in the mortality rate overall. The relative risk of experiencing multiple complications also increase significantly, showing a 3.17-fold increase with severe HR.

Mortality risk increased by 1.75 times ($p < 0.001$) in patients with severe HR. A thorough examination provided additional evidence of a separate link between HR and post-STEMI complications in this study. The study's Kaplan-Meier curves indicated that survival was lower overall for people with higher HR scores.

Conclusion

Findings of our study indicates that 27% diagnosed patients exhibited signs of HR with acute STEMI. This indicates a significant incidence of hypertensive retinopathy in individuals experiencing this particular cardiovascular event. Further research and clinical attention may be necessary to understand the implications of hypertensive retinopathy for management and prognosis of acute STEMI.

LIMITATION OF THE STUDY: The lack of analysis regarding medication use following STMI for retinopathy is one of the primary limitations of this study. However, conducting further research with larger sample sizes and long term follow-up would enhance our comprehension of the relationship between hypertensive retinopathy in patients presenting with STEMI.

ACKNOWLEDGEMENT: The authors wish to acknowledge the support of the staff members of clinical research department of the Lady reading hospital Peshawar, Pakistan. The authors would also like to acknowledge the Medical Affairs department of Getz Pharma for their technical support and assistance in the publication process.

References

1. Themistocleous I, Stefanakis M, Douda HT. Coronary heart disease part I: pathophysiology and risk factors. J Phys Act Nutr Rehabil. 2017;3:167-75.
2. Mitsis A, Gragnano F. Myocardial infarction with and without ST-segment elevation: a contemporary reappraisal of similarities and differences. Curr Cardiol Rev. 2021 Jul 7;17(4). https://doi.org/10.2174/1573403X16999201210195702
3. Sideri AM, Kanakis M, Katsimpris A, Karamaounas A, Brouzas D, Petrou P, Papakonstaninou E, Droutsas K, Kandarakis S, Giannopoulos G, Georgalas I. Correlation between coronary and retinal microangiopathy in patients with STEMI. Transl Vis Sci Technol. 2023 May 1;12(5):8-. https://doi.org/10.1167/tvst.12.5.8
4. Virani SS, Alonso A, Aparicio HJ, Benjamin EJ, Bittencourt MS, Callaway CW, Carson AP, et al. Heart disease and stroke statistics-2021 update: a report from the American Heart Association. Circulation. 2021;143
5. Picariello C, Lazzeri C, Attana P, Chiostri M, Gensini GF, Valente S. The impact of hypertension on patients with acute coronary syndromes. Int J Hypertens. 2011 Jun 22;2011. https://doi.org/10.4061/2011/563657
6. Jibran MS, Habib SA, Khan SB. Hypertensive retinopathy: a prognostic factor for morbidity and mortality after acute ST elevation myocardial infarction. J Coll Physicians Surg Pak. 2019 Mar 1;29(3):205-9. https://doi.org/10.29271/jcpsp.2019.03.205
7. Duncan BB, Wong TY, Tyroler HA, Davis CE, Fuchs FD. Hypertensive retinopathy and incident coronary heart disease in high-risk men. Br J Ophthalmol. 2002 Sep 1;86(9):1002-6. https://doi.org/10.1136/bjo.86.9.1002

8. Balla S, Vajas A, Pásztor O, Rentka A, Lukucz B, Kasza M, Nagy A, Fodor M, Nagy V. Analysis of the association between retinal artery occlusion and acute ischaemic stroke/ST-elevation myocardial infarction and risk factors in Hungarian patients. Medicina. 2023 Sep 18;59(9):1680. https://doi.org/10.3390/medicina59091680
9. Poznyak A, Grechko AV, Poggio P, Myasoedova VA, Alfieri V, Orekhov AN. The diabetes mellitus-atherosclerosis connection: the role of lipid and glucose metabolism and chronic inflammation. Int J Mol Sci. 2020 Mar 6;21(5):1835. https://doi.org/10.3390/ijms21051835
10. Zarkali A, Cheng SF, Dados A, Simister R, Chandratheva A. Atrial fibrillation: an underestimated cause of ischemic monocular visual loss? J Stroke Cerebrovasc Dis. 2019 Jun 1;28(6):1495-9. https://doi.org/10.1016/j.jstrokecerebrovasdis.2019.03.017
11. Zahoor S, Mahboob HM, Jehangir HM, Mehmood B, Khan A, Iqbal U. Frequency of retinal hemorrhage after thrombolysis with streptokinase in patients presenting with ST-elevation myocardial infarction: a single-center experience at a large tertiary care center in Lahore, Pakistan. J Fatima Jinnah Med Univ. 2021 Dec 7;15(2):87-90. https://doi.org/10.37018/BXOS4371
12. Lee S, Gjerde H, Gubitz G. Retinal and choroidal haemorrhage after tissue plasminogen activator administration. Can J Neurol Sci. 2017 Jul;44(4):461-2. https://doi.org/10.1017/cjn.2017.35
13. Peyman M, Subrayan V. Irreversible blindness following intravenous streptokinase. JAMA Ophthalmol. 2013 Oct 1;131(10):1368-9. https://doi.org/10.1001/jamaophthalmol.2013.4489
14. Wang J, Zhao M, Li SJ, Wang DZ. Retinal artery lesions and long-term outcome in Chinese patients with acute coronary syndrome. Eye (Lond). 2015 May;29(5):643-8. https://doi.org/10.1038/eye.2015.2
15. Kabedi NN, Lepira FB, Kayembe TK, Kayembe DL, Mwanza JC. Hypertensive retinopathy and its association with cardiovascular, renal, and cerebrovascular morbidity in Congolese patients. Cardiovasc J Afr. 2014;25:228-32. https://doi.org/10.5830/CVJA-2014-045
16. Goto I, Katsuki S, Ikui H, Kimoto K, Mimatsu T. Pathological studies on the intracerebral and retinal arteries in cerebrovascular and noncerebrovascular diseases. Stroke. 1975;6:263-9. https://doi.org/10.1161/01.STR.6.3.263
17. Kram MK, de Jong FJ, Vingerling JR, Witteman JC, Hofman A, Breteler MM, et al. Are retinal arteriolar or venular diameters associated with markers for cardiovascular disorders? The Rotterdam Study. Invest Ophthalmol Vis Sci. 2004;45:2129-34. https://doi.org/10.1167/iovs.03-1390
18. Wong TY, Klein R, Nieto FJ, Klein BE, Sharrett AR, Meuer SM, et al. Retinal microvascular abnormalities and 10-year cardiovascular mortality: a population-based case-control study. Ophthalmology. 2003;110:933-40. https://doi.org/10.1016/S0161-6420(03)00084-8
19. Wong TY, Klein R, Couper DJ, Cooper LS, Shahar E, Hubbard LD, et al. Retinal microvascular abnormalities and incident stroke: the atherosclerosis risk in communities study. Lancet. 2001;358:1134-40. https://doi.org/10.1016/S0140-6736(01)06253-5